

SOIL MOISTURE MANAGEMENT DECISION AIDE

About the Decision Aide

The Soil Moisture Management Decision Aide was designed to provide information that could be used along with past experiences, other information about cropping systems such as soil fertility, herbicides, crop rotations, crop varieties, conservation practices, and economic conditions. This tool is not designed to be used in isolation of other information but as a supplement when making decisions about your farming system. Proper rotations need to be selected prior to running this tool. Rotations with the intensity and diversity necessary your region need to be selected and then modified as annual moisture management dictates. In particular, cropping decisions need to take into account the effect of your cropping system on diseases, pests, weeds, fertility, genetics, and soil conservation. The results of this tool apply probabilities only to the problem of dryland soil moisture management. The tool assumes that all other aspects of the management system are optimized for your chosen tillage system.

An accompanying power point presentation illustrates the various mechanical steps to use when using the decision aide. The more important process of integrating this information with your past experience and other cropping system information is left up to you and various consultants or advisers that may be working with you. The decision aide does a good job of presenting soil, crop, climate, and tillage information as a unit to give an idea of how these resources combine together to affect crop production based on water availability during the growing season.

Soil and Climate

The Soil Moisture Management Decision Aide was developed with a daily simulation model called EPIC that used historic weather statistics from Wall, Bison, and Pierre, South Dakota (SD), to simulate seasonal weather patterns. The seasonal weather patterns are the main contributor to the yield probability distributions in the decision-making aide. The yields predicted by the model were calibrated against crop production studies and variety trials from Wall, Bison, and Pierre, SD. Additional results from research trials from the Great Plains were used to help check the reasonableness of model output. Soil information was used to adjust the model results for agricultural soils using soil productivity ratings published by the Natural Resources Conservation Service (NRCS).

Tillage and Crop systems

The EPIC model primarily distinguishes between tillage systems based on the amount of residue and canopy cover associated with these systems on a daily basis. The model accounts for residue decay and for crop growth based on distribution of moisture, temperature, and soil water storage during the growing season. The model was not run for different slopes so it does not account for differences in runoff in the tillage systems. As a result, if your field has significant slope then fields with low residue cover will have lower yield probabilities than predicted by this Soil Moisture Management Decision Aide.

Initial Soil Moisture Conditions

The model allows for different initial soil moisture contents at the beginning of the year. The beginning of the year is defined here as January. The reason for choosing January rather than

April or May is that the use of a tool such as this is more likely to be used for planning in winter rather than in the rush of planting season. There are three initial soil moisture contents used in the decision aide, dry, average, and wet. Dry represents a very dry soil profile with no water available for plant growth in the root zone. Wet represents a soil profile that is full in terms of water storage capacity for the entire root zone (usually down to at least three feet). The average initial soil moisture content is in-between these two extremes. In western South Dakota, the soil profile is rarely completely full or completely dry in January so it is most appropriate to use the average setting in most years. The dry setting should be used for those times when last year's growing season was very low in precipitation and the fall season was also quite dry. This setting would definitely be used when the weather service describes your area as being in a drought situation. The topsoil and subsoil should both be lacking water to use this setting. The wet setting should be used if the fall was abnormally high in precipitation and the preceding growing season was not particularly dry. The topsoil and subsoil should be at full water storage to use this setting.

On Probability

Agricultural decisions are based on an evaluation of probabilities. Often the probabilities of a particular course of action are not stated or known. If a number is not given for a probability we might believe that our decisions are free of such considerations. In reality, whenever we decide a course of action in our agricultural enterprise we are weighing potential risks and benefits. We often do not put a number to quantify risks and benefits instead our mind weighs our perceptions of probabilities (possible outcomes) to help us make a decision. How does our perception of these possible outcomes arise? The main information that we rely on is our past experience and the past experiences of others. Our mind takes the many bits of information from past experiences combines them with our understanding of how the world works, and recognizes our goals to help us formulate a decision. We weigh these pieces of information consciously and subconsciously, get a feel for what we believe is best, and then make our decision. The decision making process is our best estimate of the likely outcome of a chosen course of action and our ability to weather the consequences of an unexpected outcome. In other words, everyday decision-making is based on an unquantified and unstated concept of probability.

Decision-making aides in agriculture are based on probabilities. As an example, variety trials, soil tests, market forecasts, and conservation management tools such as the erosion prediction tool, RUSLE, are all based on probability. A probability is often designed into the aide. The usual probability being a 5 percent to 10 percent chance of being wrong provided that the aide is applied to similar conditions that produced the data used in the decision making aide. As an example, if variety trials were conducted 200 miles to the east of our location then we would expect a lower probability that the variety trial results would apply to our conditions.

The soil moisture decision aide uses the concept of probabilities to provide information that can be used alongside experience, acquired information, and agronomic and economic principles to help make a cropping decision. This aide is different from other decision making aides in that it describes low, medium, and high yield probabilities that the producer can choose based on their evaluation of how well they can handle risk in the coming growing season.

A low probability yield level in the decision aide represents a yield level that may be reached or exceeded only 25 percent of the time. In other words, yields below this level should be expected 75 percent of the time for the given soil, crop, and region.

A high probability describes a yield level that may be reached or exceeded 75 percent of the time. Yields should be expected to be below this yield level 25 percent of the time for the given soil, crop, and region.

A medium probability describes a yield level that may be reached or exceeded 50 percent of the time for the given soil, crop, and region.